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Local effects of depth-dependent water content of ice and snow and firn layers temperature on a conjectured subglacial lake below Amundsenisen Icefield (Svalbard).

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It is known that the Amundsenisen Icefield in Southern Spitzbergen (Svalbard achipelago) is temperate with an upper layer of snow and firn. It is an accumulation area and, though ice/water mass balance is clearly subject to time evolution, observation data on the long-term elevation changes over the past 40 years (Nuth et al., 2010) allow to assume constant icefield surface.
Within our study of the plausibility of a subglacial lake (Glowacki et al., 2007), here, we focus on the sensitivity of the system to the thermal effect of the firn and snow layers.
As water content of ice have significant consequences on its rheology and dynamics but direct quantitative measurements of it are not presently available to our knowledge, in this work we adopt a continuous fit between water content and the fourth power of the normalized depth along with the procedure adopted by Vallon et al. (1976), for the temperate glacier Vallee Blanch, French Alps, and by Breuer et al. (2006), for the King George Island ice cap in Antarctica.
We support our investigation with simulation via an in-house numerical code (Bucchignani et al., 2012) based on a thermomechanical transient model with dynamics given by a full Stokes system for the icefield and Large Eddy Simulation formulation for the water basin. Ice rheology is represented by Glen's law (n=3) with flow rate factor depending both on water content and temperature according to Breuer et al. (2006), for similar environments. Firn and snow thermal profiles are assumed to be steady. Their numerical values are partly (firn) available from Zagorodnov et al. (1985) and completed by matching the annual average air temperature at the surface. We compare simulations performed with and *without* firn and snow layers.

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